PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 4 :		(11) International Publication Number:	WO 88/ 02588
H04N 5/76	A1	(43) International Publication Date:	7 April 1988 (07.04.88)

(21) International Application Number: PCT/SE87/00426

(22) International Filing Date: 22 September 1987 (22.09.87)

(31) Priority Application Number: 8604024-3

(32) Priority Date: 24 September 1986 (24.09.86)

(33) Priority Country: SE

(71)(72) Applicant and Inventor: TOGERETZ, Conny [SE/SE]; Postlåda 265, S-140 41 Sorunda (SE).

(74) Agents: HERMANSSON, Birgitta et al.; AB Dahls Patentbyrå, Box 19519, S-104 32 Stockholm (SE).

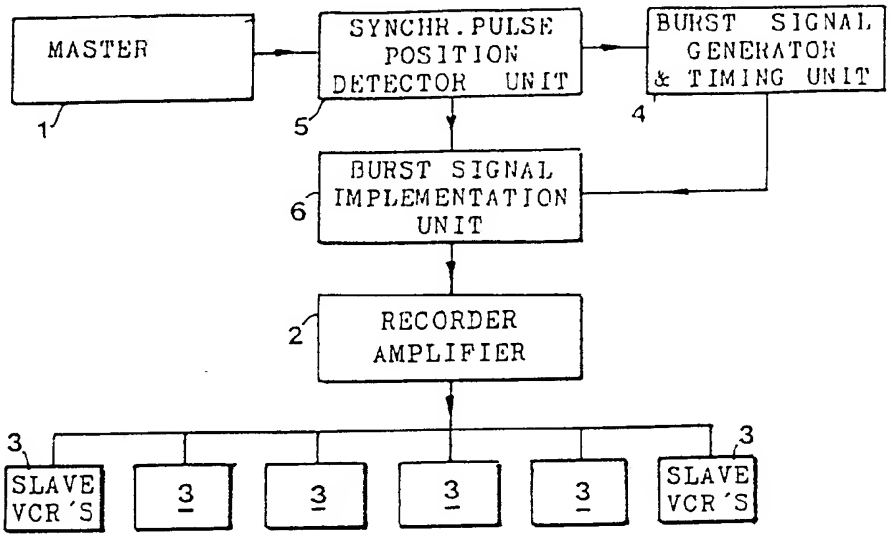
(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BG, BJ (OAPI patent), BR, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CM (OAPI patent), DE, DE (European patent), DK, FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.

Published
With international search report.
In English translation (filed in Swedish).

(54) Title: METHOD OF PREVENTING UNAUTHORIZED REPRODUCTION OF THE CONTENT OF VIDEO CASSETTE TAPES AND APPARATUS FOR EXECUTING THE METHOD

(57) Abstract

Method of preventing unauthorized copying of the content of video cassette tapes, particularly suited to be used for simultaneous production of a plurality of video tape cassettes to be held for sale and each comprising a re-recording of the video signal recorded on an original video tape and having conventional vertical synchronizing (vs), horizontal synchronizing (hs), and picture signal (10) portions. The original video tape is played back in a back-playing video unit (1) and the video signal generated by this unit is applied to a number of recording video machines (3) for recording the tapes of a corresponding number of video cassettes after having been superimposed with a modifying signal, the purpose of which is to impede copying of the video cassettes thus produced. According to the invention, the video signal produced by said back-playing video unit (1), while being transferred to the recording video machines (3), is superimposed with a modification signal (11, Fig. 3), the amplitude of which is several times larger than the amplitude of the vertical and horizontal synchronizing signals, and preferably larger than the maximum amplitudes of the picture information portions (10) of the video signal. This modification signal consists of bursts of a plurality of individual impulses within the signal intervals (vs + ihs) and preferably a pulse repeating frequency which is in the range of 20 to 50 kHz. Further, the invention relates to an apparatus for executing this method.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	ML	Mali
AU	Australia	GA	Gabon	MR	Mauritania
BB	Barbados	GB	United Kingdom	MW	Malawi
BE	Belgium	HU	Hungary	NL	Netherlands
BG	Bulgaria	IT	Italy	NO	Norway
BJ	Benin	JP	Japan	RO	Romania
BR	Brazil	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic			SE	Sweden
CG	Congo	KR	Republic of Korea	SN	Senegal
CH	Switzerland	LI	Liechtenstein	SU	Soviet Union
CM	Cameroon	LK	Sri Lanka	TD	Chad
DE	Germany, Federal Republic of	LU	Luxembourg	TG	Togo
DK	Denmark	MC	Monaco	US	United States of America
FI	Finland	MG	Madagascar		

Method of preventing unauthorized reproduction of the content of video cassette tapes and apparatus for executing the method.

This invention relates to a method of preventing unauthorized copying of video tape cassette recordings and an apparatus for executing the method. The method is based on a procedure by which, when producing video cassettes intended to be held for sale or lease by copying (dubbing) an original video tape recording, strong signal components are introduced into the video signal to be recorded, which signal components modify the recorded signal in such a manner that, should the video tape thus produced be unduly copied, a satisfactory video picture of such "pirate" video tape would not be reproduceable, while, however, the authorized "original copies" produced by means of the method according to the invention are reproduceable in conventional video tape recorders (VTR:s) without the modifying signal recorded thereon adversely influending the reproduction quality of the video picture.

In the event that an "original copy", produced according to the invention, is being copied, the modification signal applied to it will have an influence on the recording signal of the copying VTR that such copies of the "original" copy, when played back, will give rise to inacceptable pictures: The picture rolls, loses colors and synchronization. Thus, when copying an original copy produced in accordance with the invention, the modification signal acts as an interference signal which effectively destructs the entire picture content of the video tape.

Prior art regarding recording of video tapes does not seem to have been concerned with measures for producing multiples of recorded video tape copies for sale, which are provided with signal components suited for impeding and preventing a production of usable video tapes by "pirate copying".

This invention relates to a method of this kind which is particularly suited to be used for producing, by simultaneous copying, a plurality of video tape cassettes intended to be held for sale or let out on hire and each containing a copy of a video signal recording on an original video tape, a 1"-tape for instance, comprising vertical and horizontal synchronizing signal, color signal, and picture signal portions, and in which the recorded signal has been modified in accordance with the invention to make difficult or prevent production of useable copies by copying the cassettes thus produced.

According to this invention the method of recording (dubbing) such video tape cassettes is executed in such a manner that the video signal generated by a unit back-playing an original video tape (usually a so called 1"-machine) within the signal intervals thereof which for each picture contain the vertical synchronizing signal and/or the signal interval immediately following the vertical synchronizing signal, within which interval the video signal for each picture contains a first number of horizontal synchronizing signals which, during the immediately following line period, do not contain picture information signal, while being transferred as input signal to a video tape recording apparatus for recording video tapes of video cassettes intended to be held for sale, is superimposed by a modification signal, the amplitude of which is several times larger than the amplitude of the vertical and horizontal synchronizing signals and preferably several times larger than the normally maximum amplitude of the picture information signal portions of the video signal.

Due to the presence on the video cassette tape of a modified signal thus produced, located within said intervals of the recorded signal, the automatic gain control (AGC) which is always present in conventional equipments for recording and back-playing video cassette tapes and which control the recording level in dependence of the amplitude of the synchronizing pulses, when copying a video cassette recorded according to the invention is supplied with an entirely erroneous control signal for the AGC, and, due to the presence of the modification signal, brings down the recording signal to such low level that the picture and synchronization signal content recorded on the copy tape is incapable of producing an acceptable video picture.

Preferably, the modification signal, or at leat a larger part thereof, is applied within the interval of said first number of horizontal synchronizing pulses during a picture frame which is not immediately followed by picture content signal, the influence of the depression of the amplification of the then following horizontal synchronizing pulses and picture signal during the following picture being maximum.

The main frequency of the modification signal should be adjusted so as to be located within the range of maximal sensibility of the automatic gain control of the recording machines normally necessary for producing acceptable copies of video tapes. This maximal sensibility is usually present in the range of 20 to 50 kHz, somewhat varying for different picture systems in dependence of the horizontal synchronization frequency.

In order to render more difficult measures to eliminate the influence of the modification signal implemented in slave copies produced according to the invention, which signal thus acts as a disturbance signal, it is preferred that the modification signal is implemented in the form of signal bursts in each picture sequence, the length and/or position of which within said interval is being continuously varied, preferably at random.

Obviously, such modification signal is not to be implemented in the video signal in such a manner that the leading (earliest) edge of the vertical synchronizing pulses which trigger the frame change is disturbed, and neither it is to be present in portions containing picture information, where it would result in white lines or fields in the picture.

The scope of the invention and preferred embodiments thereof appear from the appended claims.

The method according to the invention for producing video cassettes containing "original copies" of original video tape recordings appears more in detail from the following description in conjunction with the accompanying drawing showing a preferred embodiment thereof and graphic representations illustrating the recording procedure according to the invention, as well as the attained result.

On the drawing,

Figure 1 shows a block diagram of an apparatus for simultaneous production of a plurality of copies of an original video tape, said copies being modified according to the invention,

Figure 2 is a graph showing such portions of a video signal generated by a back-playing videomachine and of special interest in connection with the modification of this video signal which is introduced according to the invention while copying the orignal tape,

Figure 3 illustrates an implementation of the method according to the invention, and

Figure 4 illustrates a result of a recording obtained on a video tape produced by copying in a conventional video tape recorder a video cassette tape produced according to the invention.

In Fig. 1 block 1 represents an apparatus comprising a video machine 1 for back-playing an original tape, a 1"-tape, for instance, and pertaining means for automatic gain control, AGC, in dependence of synchronizing impulses and color beam. This apparatus, below called master, delivers at its output terminals a duly adjusted video signal which, when producing

tapes in or for cassettes intended to be used in conventional VTS:s, is usually applied directly to a booster amplifier 2, to the output terminals of which is connected a plurality of video tape recording machines 3, slaves, in which tape cassettes intended to be held available to the public are produced.

In portions of the video signal which are of interest in connection with the invention, the signal as delivered by the master, block 1, has the conventional waveform as illustrated by Fig. 2, in which along the time axis t the signal intensity I is shown for a vertical synchronizing signal, the time vs, and the first portion of the time hs during which the horizontal synchronizing signals are present. The region of the horizontal synchronizing pulses at the beginning of lines following immediately afte the vertical synchronizing signal, the pulse sequence vs and which, for each line, do not contain picture information signal, is marked ihs. This last mentioned region, in particular, is of interest in connection with this invention, although part of the interval vs may as well be utilized, however not to such an extent as to spoil the vertical synchronization.

An apparatus for executing the method according to the invention differs from the conventional arrangement in which, as described, a video signal having a progress corresponding to the one illustrated by Fig. 2 is directly transferred from a master unit to one or more slave video cassette recorders (VCR's) via a booster amplifier 2, in that it comprises means for implementing on the video signal delivered by the master a pulse train, the pulses of which occur within the said intervals vs and ihs. The signal thus obtained is supplied to the booster amplifier 2 so that the signal recorded on each slave cassette tape within said intervals contains information actuating the automatic gain control of a conventional video tape recorder eventually used for copying such a slave cassette so as to shatter essential parts of the video signal recorded on the unauthorized copy.

In a preferred embodiment, said means comprise a pulse train generator unit 4 for generating signals in the form of a pulse train required for modifying the video signal and comprising means for setting duration, position in time, and amplitude of the pulses of said pulse train, a detector unit 5 for detecting the time of appearance of the interval (vs + ihs) of the video signal intended for implementation of the modification signal, and a pulse implementation unit 6 for superpositioning the modification signal pulses on the video signal within said interval (vs + ihs) thereof. On its way from the master 1 to the booster amplifier 2, the video signal passes the

detector unit 5. At the appearance of a vertical synchronizing signal, the detector unit 5 delivers a trigger signal to pulse train generator 4, causing this unit in dependence of choice of pulse position and pulse train duration within the synchronization interval (vs + ihs) for each picture to deliver a pulse burst to pulse implementation unit 6, in which unit said pulse burst is superimposed on the video signal within the time interval determined by means of said pulse duration setting means of the pulse train generating unit 4, e.g., as shown in Fig. 2, a pulse train with the duration p.

Fig. 3 illustrates an example of the shape of signal obtained after the pulse implementation and applied to the booster amplifier 2, a shape which can as well be said to be representative for the shape of the recording obtained on the tape of video cassettes produced in the slave machines 3. In such parts of the recorded video signal where no modification signals have been added, the shape and amplitudes of the recorded signal exactly correspond to the signal shown in Fig. 2 and do, consequently, constitute a recording exactly corresponding to the original one. A burst of pulses 11 are superposed on the video signal during the interval between the arrows 8 (in Fig. 2 the interval p_3) located within the interval (vs + ihs) mentioned above and in Fig. 3 indicated by arrows 9. The amplitude in the recorded signal of the maximum picture signal portions on the tape may be presumed to originate from a signal amplitude in the signal transferred to the booster amplifier 2 from the pulse implementation unit 6 having a maximum signal strength e, the amplitude of the signal then appearing during the implementation then being a factor k larger than e. The value of k may preferably be between 3 and 6. The optimum value is to some extent depending on the amplitude of the color beam at the beginning of the original tape, "the 1"-tape" if such tape is used, and adjusted correspondingly. Due to magnetic saturation, however, the magnetic counterpart to the factor k as regards the efficiency of the recording on the tape during play-back, may, within the range of the response characteristic of the tape material above the range used for the picture signal, be much lesser than the k value in the electric signal when recording.

When playing back a cassette with a recording corresponding to the one illustrated by Fig. 3 for the signal used when recording the cassette, during which play-back the maximum amplitudes of this signal may, of course, be relatively less pronounced and not have the same relation to the maximum picture signal as in the signal applied to the booster amplifier, the

representation of the picture will not be disturbed by the modification signals.

The graph of Fig. 4, in which the scale of the ordinate axis is considerably smaller than in Fig. 3, illustrates in principle the shape of a signal recorded on a video cassette tape when copying a video tape cassette produced according to the invention by means of a domestic video tape recorder equipped with conventional recording facilities. Due to the strong modification signal implemented on the tape of the "pirate" cassette, the AGC of the VTR, actuated by the modified signal, presses down the amplification of the VTR in such degree that the recording present on the copy cannot be used for playing back an acceptable video picture.

Thus, when copying a cassette which is duplicated according to the invention in a domestic video tape recording unit, the large amplitude of the implemented signal 11, Fig. 2, lowers the amplification in the unit to such an extent that the amplitude of the recording e_r of this signal on the copy during play-back will not be larger than in the order of 0,2 to 0,5 of the maximum magnitude $\underline{e}$ of the picture signal 10, the picture signal being lowered in the same relation.

As an illustrative example may be mentioned that a video cassette tape having a recorded signal generally corresponding to the ones shown in Figs. 2 and 3 was copied in a video recording machine delivering a highest peak-to-peak-voltage of 1 volt in accordance with known standard.

In Fig. 3 this voltage is represented by the intensity I=e and is set by the AGC of the machine in dependence of the amplitude of the synchronization signals at the beginning of a line sequence within each picture. In test copying procedures executed by implementing modification signals in accordance with the present invention, the values of the characters pulse amplitude, pulse duration, pulse position, and pulse frequency were varied from part to part of copies thus produced. Subsequently, such copies were copied in a conventional video machine equipped with tape copying facilities, whereafter the signal obtained from such "pirate copies" was measured in the same manner as the signal obtained from the original. It was found that the peak voltage generated at regions of the signal implemented according to the invention by its influence on the AGC of the tape recorder used for the "piracy copying" had brought down the entire signal level such that the maximum signal amplitude within the region of the modification signals 11, the amplitude e_r in Fig. 4, was no more than 200-500 mV, i.e.

0,2xe to 0,5xe. The picture content of the signal was all through insufficient for producing an acceptable picture. In tests with high quality tapes it was found that an effective interference lasting during the entire subsequent picture was obtained by use of a modification signal having such amplitude that the control signal applied to the input terminals of the recording machine had a p-p-voltage amounting to 3,8 times the video signal p-p-voltage (i.e. 3,8 volts in the "standard" case). Further it was found that the use of an implemented modification signal of such magnitude that the p-p-voltage of the applied control signal exceeded 5,2 volts caused interferences as well when back-playing cassette copies produced according to the invention.

It is an obvious matter that a best choice of amplitude, frequency, duration and position of the modification signal may vary in dependence of the properties of the signal recording material in video tapes used, as well as of picture reproduction system characteristics, different synchronization frequencies for instance. The man skilled in the art may, however, easily by means of tests choose such properties for the implementation signal to be used as described above to fulfill the purpose according to the invention. The circuits which constitute components of the pulse train generator unit 4 of an apparatus according to the invention and which determine the characters frequency, amplitude, duration, and position of the modification signals, whether said circuits are arranged for having an invariable or a variable influence on the signal, may be arranged on the basis of well known technique and, of course, in the latter case the control of the variation, at random for instance, of one or more of said characters may be provided for by means of computer.

CLAIMS

1. A method for preventing unauthorized copying of a video cassette recording, particularly suited to be used for producing, by simultaneous copying, a plurality of video tape cassettes intended to be held for sale or let out on hire and each containing a copy of a video signal recorded on an original video tape and comprising vertical synchronization (vs), horizontal synchronization (hs) and picture information (10) signal portions, in which method the original video tape is played back by means of a back-playing video unit (1) and the video signal thus produced is applied to at least one video signal recording machine (3) to produce a video tape copy, c h a r a c - t e r i z e d in that said played back video signal while being transferred to said at least one machine (3) is superposed with a modifying signal (11, Fig. 3), the amplitude of which being several times larger than the amplitude of the vertical and horizontal synchronizing signals of the played back video signal, the implementation of this modifying signal on the video signal being effected within the signal intervals of the video signal which, for each picture, include the vertical synchronizing signal (vs) and/or the signal interval immediately following the vertical synchronizing signal, within which interval the video signal for each picture contains a first number of horizontal synchronizing signals (ihs) which during the immediately following line period do not contain picture information signal, and that said modification signal consists of bursts of a plurality of individual impulses located within said intervals (vs+ihs).

2. A method according to claim 1, wherein said modification signal has an amplitude sufficiently large to impart to the video signal applied to said at least one recording machine (3) a maximum amplitude which, during occurrence of modification signal, is at least as large as the maximum amplitude of the video signal within the picture information signal portions (10).

3. A method according to claim 2, wherein the modification signal (11) has an amplitude sufficiently large to impart to said video signal an amplitude which, during occurrence of modification signal is at least tree times as large as the maximum amplitude of the video signal within the picture information signal portions (10).

4. A method according to anyone of the previous claims, wherein said modification signal at least to a larger part thereof is superimposed on

the video signal within the interval (ihs) of said first number of horizontal synchronizing signals not immediately followed by picture information signal during play-back of each picture.

5. A method according to anyone of the previous claims, wherein said modification signal has a frequency of separate pulses within the range 20 to 50 kHz.

6. An apparatus for executing the method according to anyone of the previous claims comprising a video machine (1) for playing back a video tape to be copied and a recorder amplifier (2) for adapting video signals generated by said back-playing video machine for re-recording said video signals by means of at least one recording machine (3), said apparatus being c h a r a c - t e r i z e d by comprising means for superimposing signals onto the video signal generated by said video machine (1) within the time intervals (vs+ihs) of this signal which, for each picture, comprise a vertical synchronizing signal (vs) and a number of such horizontal synchronizing signals (ihs) which follow immediately after said vertical synchronizing signal and which are themselves not immediately followed by picture information signal, said means comprising a pulse train generator unit (4) for generating a pulse train (11) having a pulse repetition frequency chosen so as to allow an implementation of a plurality of individual impulses within each one of said time intervals (vs+ihs) of the video signal, a detector unit (5) for ascertaining the time of appearance of said vertical synchronizing signals and generating a signal for trigging said generator unit (4) to generate a pulse train (11) of a predetermined duration during said time intervals (vs+ihs), and a pulse implementation unit (6), arranged in the signal path from said back-playing video machine (1) to said amplifier (2) for superimposing a pulse train generated by said pulse generator unit (4) on the video signal within said time intervals (vs+ihs) thereof.

7. An apparatus according to claim 6, wherein said pulse train generator unit comprises means for varying at least one of the following characters: duration of pulse trains, duration of pulses of said pulse trains, position of pulse trains within said time intervals (vs+ihs), amplitude of impulses of said pulse trains, shape of impulses of said pulse trains.

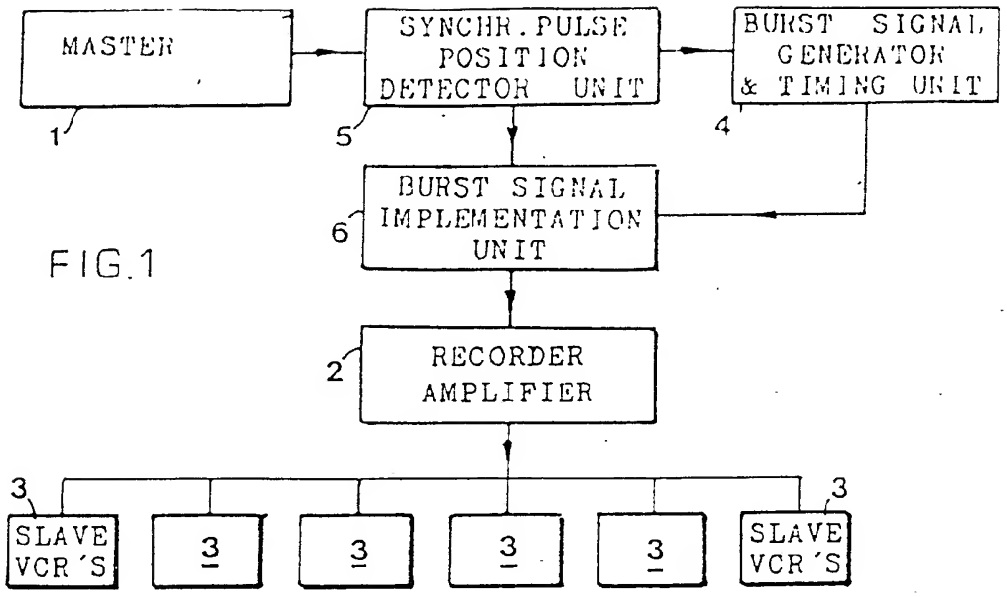
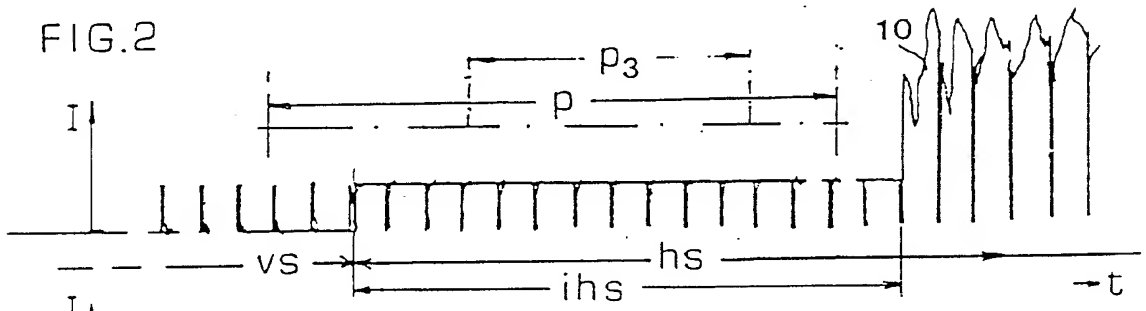


FIG.1

FIG.2



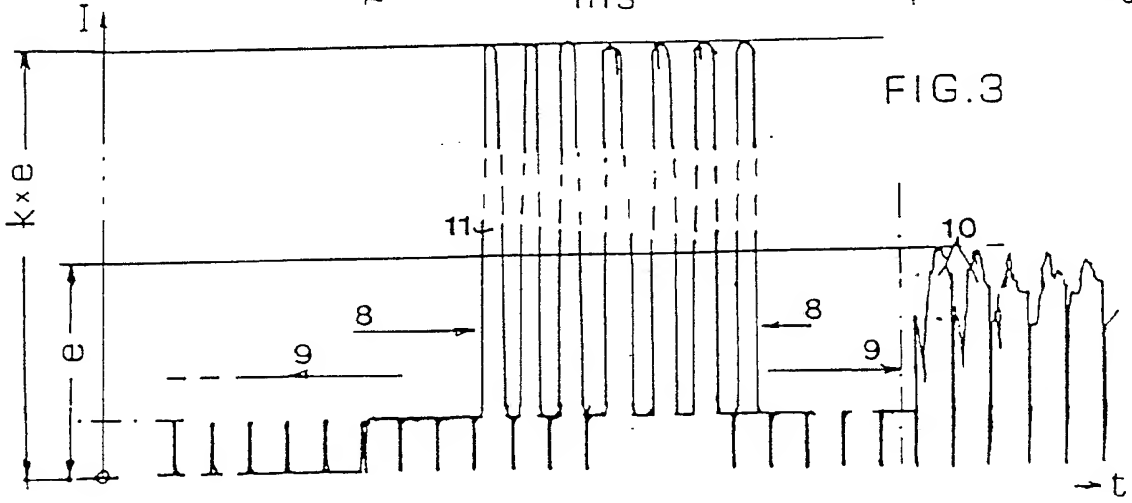


FIG.3

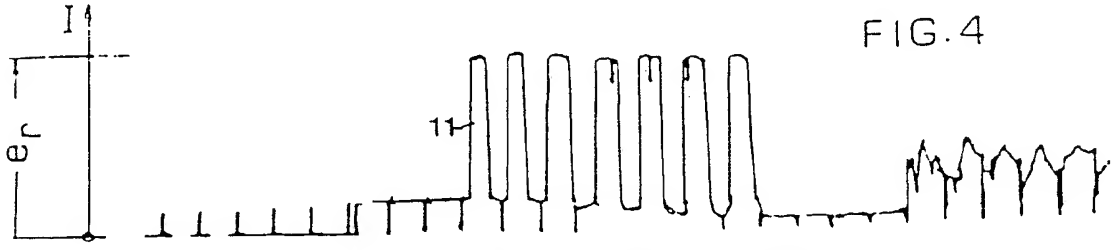


FIG.4

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE87/00426

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC 4

H 04 N 5/76

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC 4	H 04 N 5/78, /782, /91, 9/79; G 06 F 12/14; G 11 B 23/28, 27/28, /30
US Cl	358:114, 120, 127, 145, 319; 360:29, 33, 60; 369:84

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	US, A, 4 163 253 (MORIO ET AL) 31 July 1979	
A	GB, A, 2 055 501 (I.V.S. (UK) LIMITED) 4 March 1981	

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
1987-12-01	1987 -12- 08
International Searching Authority	**Signature of Authorized Officer**
Swedish Patent Office	Gunnar Hilderot

Form PCT/ISA/210 (second sheet) (January 1985)